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# **EXHIBIT 3**

IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF CALIFORNIA  
SAN FRANCISCO DIVISION

ORACLE AMERICA, INC.,	)	
	)	
Plaintiff,	)	
	)	
v.	)	Civ. A. No. 10-03561 WHA
	)	
GOOGLE INC.,	)	(Jury)
	)	
Defendant.	)	

**SUPPLEMENTAL EXPERT REPORT OF PROFESSOR ADAM JAFFE, Ph.D.**

**March 28, 2016**

## II. QUALIFICATIONS

6. A full description of my qualifications is found in my February 8, 2016 report, and my full curriculum vitae is attached to this report as Appendix A.

7. I am being compensated in this matter at my standard rate of \$1,200 per hour. This compensation is not contingent in any way upon my testimony or upon the result of this proceeding.

## III. SUMMARY OF OPINIONS

8. In this report, I briefly discuss two important areas in which Professor Kearn's economic analysis is in my view incorrect given the context.<sup>5</sup>

9. There are a number of sound economic reasons why the copyright remedy defined in the Copyright Act as “disgorgement of profits” should not be calculated relative to a non-infringing alternative. I understand that disgorgement damages provide a means of deterring would-be infringers from copying. Use of non-infringing alternatives in a disgorgement analysis creates *ex ante* economic incentives such that the expected value of infringing is higher than the expected value of respecting the owner's copyright(s). In other words, invoking a non-infringing alternative analysis in the context of copyright infringement disgorgement of profits creates a situation in which the would-be infringer's rational economic decision is to copy without permission.<sup>6</sup> This perverse incentive is at odds with the purpose of copyright remedies, which I understand are

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<sup>5</sup> I have been asked to focus on and comment on specific economic assertions in Professor Kearn's report. However, it is worth noting that I agree with a number of Professor Kearn's arguments. First, regarding OpenJDK, I wholly agree with Professor Kearn's statement that it is surprising that Google chose to copy and continue to use Oracle's Java APIs without a license for many years, if using OpenJDK for less than \$100,000 in transition costs was actually a viable option when Android was being developed. Second, regarding Google's but-for costs, I agree that Dr. Leonard's estimates of developer training costs are unreasonably low because they do not consider that *ex ante*, the applications which will become hits are unknown. Similarly, Dr. Leonard's estimate of Google's costs to internally develop a set of hit applications suffers from the same error. Additionally, with respect to both of these but-for cost calculations, Dr. Leonard's analysis assumes without support that only “top” applications matter to an emerging platform. This is inconsistent with my understanding of early stage platform businesses and platform economics. (Expert Report of Professor James Kearn, Mar. 18, 2016, p 27-29.)

<sup>6</sup> It is worth noting that Google's damages expert Dr. Leonard has co-authored a paper on this subject. *See*, Hausman, Jerry A., Gregory K. Leonard, and Gregory Sidak. “Patent Damages and Real Options: How Judicial Characterization of Noninfringing Alternatives Reduces Incentives to Innovate.” *Berkeley Technology Law Journal* 22.2 (2007): 825-853, at 826-27 (“By ‘free option,’ we mean that a firm may keep its options open by using potentially infringing technology rather than technology that definitely does not infringe.”).

intended to discourage unlawful copying. Further, in the case of a combined offering made up of material from both the copyright owner and the infringer, the infringer (and not the copyright holder) will necessarily capture the synergies from the combination of the infringer's work with that of the copyright holder. If one purpose of copyright "disgorgement of profits" is to ensure that the infringer retains no benefit from the infringement, then the consideration of non-infringing alternatives would make it difficult or impossible, economically speaking, to achieve that goal.

10. Footnote 8 in Professor Kearl's report uses a quotation from my earlier report to suggest that I agree with his position that disgorgement of profits should be calculated relative to a non-infringing alternative. The limited quotation he uses is taken out of context, and it is clear from the original context that my use of the word "alternatives" there is with reference to a completely different question—the viability of Google using OpenJDK in the mid-2000s—and does not support or even suggest that non-infringing alternatives have a role to play in calculating disgorgement of profits.

11. My first and second reports included extensive analyses of platform economic concepts and the critical role they play in this case. The mobile market is a dynamic platform market, and the success of competitors depends on factors such as early entry, tipping points, expectations, and network effects. Google's copying of the Java API packages occurred at a time of great uncertainty in the mobile phone competition landscape. The Java API packages enabled early entry into the smartphone market and access to the developer, OEM and carrier communities, which were critical to Android's success. Professor Kearl's review and corrections to Dr. Leonard's market share analysis still use a quantitative model of customer decision-making that explicitly excludes any consideration of the effect of apps availability on the very presence of different models in the market, and is explicitly derived from and based on the mobile phone market in a time period *after* Android had avoided typical and predicted platform failure. The continued reliance on economic models that simply *assume* Android's achievement of minimal viable success fails to recognize the importance of fundamental platform economic concepts. By failing to consider even the possibility of marketplace failure of a delayed Android with untested and unknown APIs, any such analysis necessarily understates the value the Java APIs provided in allowing Android to establish itself as a viable platform competitor.

20. Another way of looking at this is by considering the *ex-ante* effect of a potential license. If the disgorgement rule is designed to deter infringement—and therefore promote seeking a license—then the disgorgement should make the infringer worse off than he would have been had he taken the license. If the copyright owner were willing to grant a license for anything less than 100% of the profits expected to be generated by inclusion of the copyrighted material, then the infringer is better off by taking the license rather than risking suit and disgorgement. Put another way, the statute acts as an incentive to bargaining and a reduction of litigation only when the infringer is at risk of losing all profits associated with the infringement.

**C. Synergies between copyrighted work and potential infringer contributions**

21. In addition to producing a scenario under which disgorgement creates no incentive for non-infringement, using non-infringing alternatives in a copyright disgorgement calculation arbitrarily awards to the infringer all value flowing from any synergies generated by the combination of the copyrighted work with other additions. This is because it is very difficult, if not impossible, for consideration of non-infringing alternatives to allocate such synergies. There are no reliable and well-accepted economic methods of which I am aware that can account for and properly allocate such synergies in constructing hypothetical valuations using non-infringing alternatives.

22. For example, imagine there are two necessary elements for platform success—J (the copyrighted work) and A (the contribution of infringer). If there are synergies between J and A, this means that the value of the combination exceeds the sum of the value of J and the value of A. Imagine further that the infringer need only compensate the copyright holder for the value of her work, as compared to the next best alternative. The effect of this is that the infringer retains both the value of its contribution *and* also all of the synergistic value. In a well-functioning market for intellectual property, A would have to pay J for J's contribution, and also share some of the value created by synergies. The parties would ordinarily be expected to bargain for a sharing of such surplus. A disgorgement remedy based only on incremental infringer's profit relative to the next best alternative does not achieve this outcome.

23. In his deposition, Professor Kearl [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]<sup>22</sup>

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>23</sup>

24. Similarly, the use of the next-best alternative construct does not provide a means to properly apportion the synergies between the copyrighted work and the contribution of the infringer. The next-best alternative, in fact, might suggest that mixed synergies (those that result from the combination) be awarded to the infringer. In addition to undermining the purposes of disgorgement, this would create a wholly speculative allocation of the synergies because of the difficulty of the problem. I understand that there is some history in the law as it pertains to apportionment in copyright disgorgement requiring the disgorgement of all profits, rather than apportioned profits, where there has been “commingling.” As I understand it, commingling occurs when the value contributed by the copyright owner is not readily separated from the value created by the infringer. The difficulty economists have in accounting for synergies provides a sound

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<sup>22</sup> Deposition of Professor James Kearl, Mar. 23, 2016, p. 206:17-207:5.

<sup>23</sup> Deposition of Professor James Kearl, Mar. 23, 2016, p. 207:12-18.

economic basis for application of this legal rule, if the purpose of the rule is to deter infringement and thereby incentivize bargaining.

#### **D. Footnote 8**

25. Professor Kearn references my February 8, 2016 report in his discussion of using non-infringing alternatives as the basis for apportioning infringer's profits:

Oracle's other economic expert, Professor Jaffe, appears to agree with me, as stated in his (corrected) February 8, 2016 report, para. 440: "As an economist, I think about the decisions companies make in light of the alternatives they are considering."<sup>24</sup>

26. Professor Kearn's reference to my report is out of context and does not substantiate his claim regarding the use of non-infringing alternatives in a copyright disgorgement of profits analysis. For context, I reproduce the paragraph that Professor Kearn is citing from my February 8<sup>th</sup> report with the quoted text bolded:

The simplest evidence that OpenJDK was not a commercially reasonable option for Google is the fact that Google did not use it. **As an economist, I think about the decisions companies make in light of the alternatives they are considering.** In 2007, when Google made the choice to commercially release Android, OpenJDK had been announced as an available option. Google did not choose to use OpenJDK for Android, which means they viewed the alternative, copying the Java API packages without a license, to be more economically beneficial. As time went on and Google was faced with litigation over its use of the Java API packages, it still chose to not use OpenJDK. ... This again suggests that Google viewed there to be significant costs or potential downsides to using OpenJDK. And that OpenJDK was not a commercially reasonable option for Google.<sup>25</sup>

The full context of the paragraph above shows I was discussing the fact that, from an economic perspective, an indicator that OpenJDK was not a plausible option for Google is reflected by the fact that Google in fact chose not pursue OpenJDK at the time it developed and launched Android.

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<sup>24</sup> Expert Report of Professor James Kearn, Mar. 18, 2016, fn. 8.

<sup>25</sup> Expert Report of Professor Adam Jaffe, (corrected) Feb. 8, 2016, paragraph 440.



## V. PROFESSOR KEARL'S AND DR. LEONARD'S TREATMENT OF PLATFORM ECONOMICS

28. In my February 8, 2016 report, I discuss platform economics at great length. In particular, I describe the role of important platform economic factors such as early entry, tipping points, expectations, and network effects.<sup>30</sup> In my second report, I further describe the very real risks of platform failure and the nonlinear nature of platform competition.<sup>31</sup> As I describe above, I do not agree that, from an economic perspective, the use of non-infringing alternatives in a disgorgement analysis is appropriate. However, to the extent that one is attempting to model an alternative outcome in a platform market, it is critical that the analysis takes into account the high degree of uncertainty and risk of failure—driven by platform economics—that is present in early stage platform markets. Given this high risk of failure, any analysis of the value of Java's contribution to Android that looks only at the marginal impact on Android *after* it was successfully established ignores a potentially very large benefit—the significant reduction in the risk of marketplace failure that Java brought by speeding introduction and allowing Android to present itself to OEMs, carriers, and app developers as a system with a proven applications interface and security model.<sup>32</sup>

29. Android's existential uncertainty absent the copying of the Java API packages is not reflected in any way in Dr. Leonard's market share damages calculations—which simulate changes to market share only after Android has achieved viability and competitive balance with the iPhone. Dr. Leonard's use of the Kim model—an econometric model based largely on post-2010 data that ignores platform economic factors such as tipping points and simply takes as a given the presence of Android phones in the market in 2010—means that Dr. Leonard's calculations cannot possibly

<sup>30</sup> Expert Report of Professor Adam Jaffe, Feb. 29, 2016, p. 17-23.

<sup>31</sup> Expert Report of Professor Adam Jaffe, Feb. 29, 2016, *see, e.g.* p. 15 (“Platform markets are subject to competitive forces that amplify the importance of market entry timing. As I describe in my February 8, 2016 report, platform markets can often only sustain a small number of competitors because of network effects. Once a given platform has reached a critical mass of users, markets can ‘tip’ which makes entry and success of competing platforms difficult. Google recognized this challenge and was therefore focused on developing a mobile platform presence to avoid getting ‘locked out.’”).

<sup>32</sup> [REDACTED]

incorporate the risk of Android failing. As I describe in my previous reports, this risk was substantial. Further, as described in my February 29, 2016 report, Dr. Leonard does not explicitly address how he incorporated an analysis of the platform economic factors facing Android as it was attempting to launch, either in his use of the Kim model, or anywhere else in his analysis.<sup>33</sup> While Professor Kearl makes certain adjustments, as I describe herein, none of these adjustments solves this problem—[REDACTED].

30. Professor Kearl provides an adjusted version of Dr. Leonard's market share analysis. However, Professor Kearl's adjustments are directed at specific assumptions that are inputs to the Kim model. Professor Kearl does not discuss the applicability of the Kim model itself, or Dr. Leonard's implicit assumption that even under significantly different conditions, Android would have been in approximately the same competitive position as the one it achieved launching with the Java APIs.

31.

<sup>33</sup> For a review of the application of these platform economic principles to the mobile phone market, *See* Bresnahan, Timothy, and Shane Greenstein. “Mobile computing: The next platform rivalry.” *The American Economic Review* 104.5 (2014): 475-480, p.7-8 (“Google entered with a purchase rather than its own development in a classic fast-follower strategy, with both defensive and offensive motives. Delay would have provided a longer opportunity to Apple, with the potential to gain such positive feedback that potentially no second entrant could succeed against. Delay also reduced the likelihood for success in competition with any other new potential entrant, or newly changed platform from among one of several established firms with the resources, such as Nokia, RIM or Microsoft. As it has turned out, events suggest fast entry was as important as the right choices over dimensions of platform differentiation.”); *see also*, “As Smartphones Proliferate, Will One Company Emerge as the Clear Market Winner?” Wharton (May 27, 2009). <http://knowledge.wharton.upenn.edu/article/as-smartphones-proliferate-will-one-company-emerge-as-the-clear-market-winner/>. (“Industry observers, including faculty at Wharton, generally agree that the smartphone market is at a tipping point ... Less clear is how the industry will evolve. Will the variety of mobile operating systems — the software that is the foundation for all the devices can do — be winnowed down to one or two, or will the Balkanization of mobile software hamper the growth of the industry?”).

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Thus, I find that Professor Kearl's adjustments of Dr. Leonard's premise (and model) for calculating market share-based damages do not and cannot fix this fundamental flaw in Dr. Leonard's model.

32. The estimates presented by Drs. Leonard and Kearnl rely on consumer choice models without consideration of the role that the copying of the Java API packages had in Android's initial viability, which renders them incomplete. Each fails to account for the imperatives of platform economics.<sup>35</sup> In particular, the models do not describe the impact of first-mover advantage (early

<sup>34</sup> Deposition of Professor James Kearl, Mar. 23, 2016, p. 186:24-187:18.

<sup>35</sup> For a review of the importance of these platform economic principles, *see, e.g.* Shapiro, Carl, and Hal R. Varian. *Information Rules: A Strategic Guide to the Network Economy*. Harvard Business Press (2013), p.68 (“First-mover advantages can be powerful and long lasting in lock-in markets, especially those in information industries where scale economies are substantial”); *see also*, Eisenmann, Thomas R. “A note on racing to acquire customers.” (2003), p. 1 (“The first company to enter a new market—the “first mover”—often has incentives to amass customers before it confronts competition. The payoff for preemption is especially strong in markets that exhibit increasing returns to scale due to network effects, learning effects, or high fixed costs.”); *see also*, Lieberman, Marvin B. “Did first-mover advantage survive the dot-com crash.” Anderson Graduate School of Management, UCLA (2005)., p. 8 (“The potential for network effects led many to anticipate strong first-mover advantages in Internet markets....Hence, in markets with network effects, the leading firm is likely to capture disproportionate returns.”).

entry),<sup>36</sup> tipping points,<sup>37</sup> network effects,<sup>38</sup> expectations<sup>39</sup> or the substantial general risk of platform failure.<sup>40</sup>

<sup>36</sup> See, e.g. Burrows, Peter, “iPhone vs Android: When It Comes To Wooing Developers, Don't Underestimate the First Mover Advantage.” BusinessWeek, (Sept. 25, 2008), [https://web.archive.org/web/20080929011922/http://www.businessweek.com/technology/ByteOfTheApple/blog/archives/2008/09/iphone\\_vs\\_andro.html](https://web.archive.org/web/20080929011922/http://www.businessweek.com/technology/ByteOfTheApple/blog/archives/2008/09/iphone_vs_andro.html). (“[T]here’s another simple reality that will also determine who comes out ahead in this Battle of the Titans. It’s Apple’s first mover advantage. Already, thousands of developers have already created apps for the iPhone.... Had Apple and Google announced their SDK on the same day, these developers may have created versions for both right away. That didn’t happen, though. Since Android came nearly six months later than Apple ... many will likely take a “wait-and-see” approach to Android. That creates a chicken-and-egg conundrum for Android, seems to me. If top developers are waiting and seeing while iPhone sales zoom ahead, it could impact or at least temper Android’s ability to get off the ground... If Google can’t quickly start creating a network effect of its own, Android could become like all those early e-auction sites that never caught up with eBay... Trying to catch up with that can be an extremely difficult thing.”).

<sup>37</sup> Schmidt, Eric, World Economic Forum, Davos Annual Meeting, “Future of Mobile Technology,” (June 2008), <https://www.youtube.com/watch?v=XjjoJyIngg>. (“It’s very difficult to project these [makes upward sloping gesture] curves, these inflection curves. And what happens in the internet is that you hit a sufficiency point. You hit a point where there’s enough people. There was a point when fax machines were roughly, roughly 20% of people had fax machines. Then all of the sudden, everyone had a fax machine. These are generally known as tipping points. There are mathematical principles behind them.”); see also, Varian, Hal R. “Art of Standard Wars.” California Management Review 41.2 (1999): 8-32, p. 10 (“Network markets tend to tip towards the leading player, unless the other players coordinate to act quickly and decisively.”); see also, Marc Rysman, *The Economics of Two-Sided Markets*, 23(3) J. Econ. Perspectives 125 (2009), p. 137 (“Two-sided markets typically have network effects and as such are likely to tip toward a single dominant platform.”).

<sup>38</sup> A long literature has documented and measured the network effect “feedback loop” between hardware sales, software availability, and consumer adoption in platform markets whereby early availability of software drives hardware sales, which in turn spurs on future software availability (and so forth). See, e.g., Gandal, Neil, Michael Kende, and Rafael Rob. “The dynamics of technological adoption in hardware/software systems: The case of compact disc players.” *The RAND Journal of Economics* (2000): 43-61; see also, Dubé, Jean-Pierre H., Günter J. Hitsch, and Pradeep K. Chintagunta. “Tipping and concentration in markets with indirect network effects.” *Marketing Science* 29.2 (2010): 216-249; see also Lee, Robin, “Vertical Integration and Exclusivity in Platform and Two-Sided Markets,” *American Economic Review* 103.7 (2013).

<sup>39</sup> [REDACTED]; see also, Shapiro, Carl, and Hal R. Varian. *Information Rules: A Strategic Guide to the Network Economy*. Harvard Business Press (2013), p.224 (“Consumer expectations are vital to obtaining the critical mass necessary to fuel growth. During the early stages of product introduction, expectations management is critical.”); see also, Zhu, Feng, and Marco Iansiti. “Entry into platform - based markets,” *Strategic Management Journal* 33.1 (2012), p.89 (“The monopoly outcome occurs when consumers and developers hold favorable expectations of one platform with respect to its future market size—they believe that everyone else will adopt the same platform. As entrants lack installed bases, consumers tend to hold favorable expectations of established platforms.”).

<sup>40</sup> Evans, David S. and Richard Schmalensee, “Failure to Launch: Critical Mass in Platform Businesses,” *Review of Network Economics* 9.4 (2010), p.3 (“With strong network effects, new networks tend either to capture the entire market (e.g., Blu-Ray) or to fail completely (e.g., HD-DVD).”).

33. As I describe extensively in each of my reports, the copying of the Java API packages by Google was critical to the success of Android. Thus, Dr. Leonard's and Professor Kearn's estimates of infringer's profits do not capture the significant value provided by the Java APIs.

## **VI. CONCLUSION**

34. As I describe above, the use of non-infringing alternatives in copyright disgorgement is inappropriate because it is inconsistent with the economic incentives that the disgorgement remedy is meant to provide. Additionally, Professor Kearn's reliance on Dr. Leonard's application of the Kim model—which continues to ignore critical aspects of platform economics such as tipping, is unreliable. The adjustments Professor Kearn performs to Dr. Leonard's analysis do not fix the fundamental error, which is that the Kim model presumes the success of Android, and Dr. Leonard attempts to apply it in a period when Android's future existence was highly uncertain.